# BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

## IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.**

(12) UK Patent Application (19) GB (11) 2 119 609 A

(21) Application No 8311657
(22) Date of filing 28 Apr 1983
(30) Priority data
(31) 3216404
(32) 3 May 1982
(33) Fed. Rep. of Germany (DE)
(43) Application published
16 Nov 1983
(51) INT CL³
H05B 6/10 F04D 19/04
(52) Domestic classification
H5H 2G2X1
F1C 103 307 601 FLB
U1S 1980 2003 H5H
(56) Documents cited
None
(58) Field of search
H2H
(71) Applicant
Arthur Pfeiffer
Vakuumtechnik Wetzlar
GmbH
(FR Germany),
Postfach 1280, Asslar 1,
Federal Republic of
Germany
(72) Inventor
Heinrich Lotz
(74) Agent and/or Address for
Service
J. F. Williams and Co.,
34 Tavistock Street,
London WC2E 7PB

(54) **Heating arrangement for a pump**

(57) In a heating arrangement for the high vacuum side of a turbo molecular pump, the rotor 2 of the pump is heated by means of a magnetic field, of which the field lines run perpendicular to the rotor axis. The magnetic field can be produced by means of permanent magnets 6 or by means of electro magnets 7. In the latter case the ohmic heat from the field windings of the electro magnets may be used to heat the stationary parts of the pump.

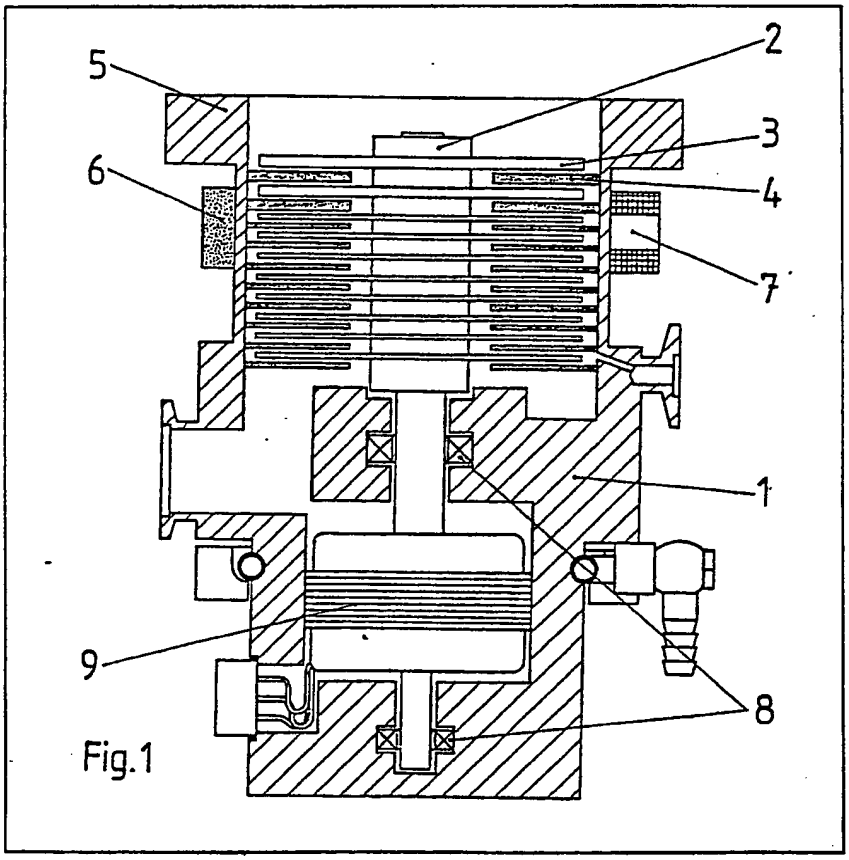


Fig.1

GB 2 119 609 A

2119609

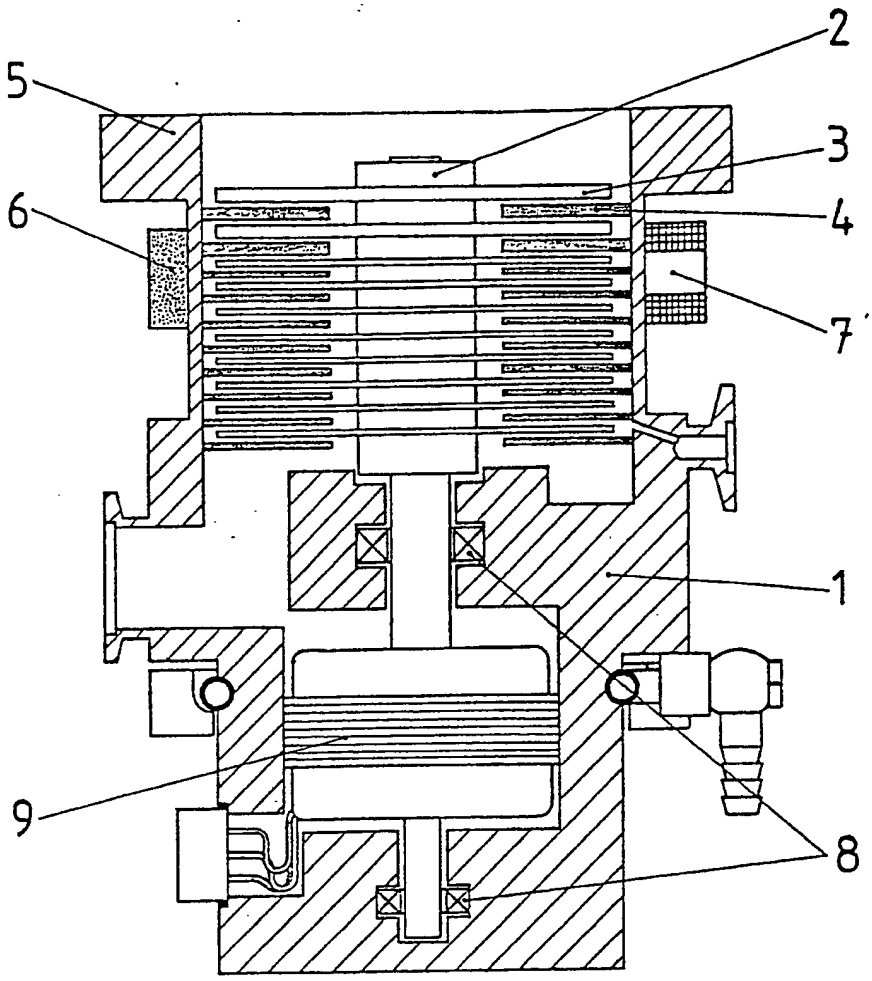


Fig.1

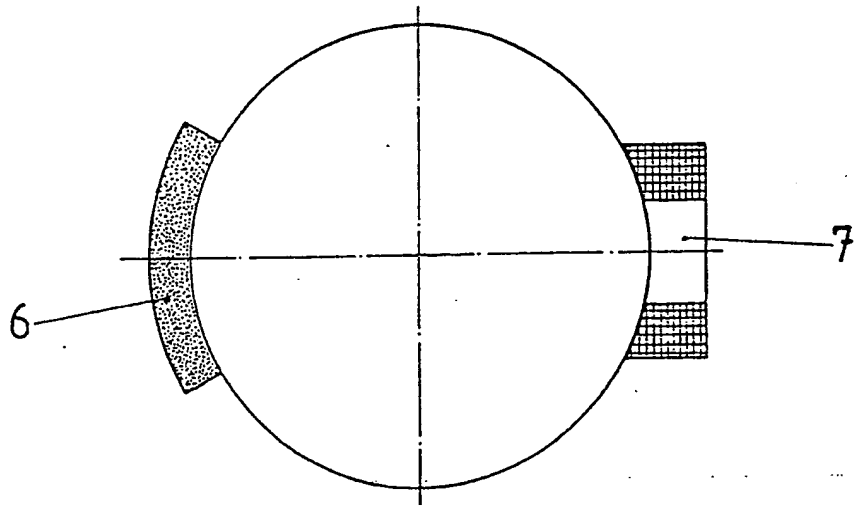


Fig.2

2119609

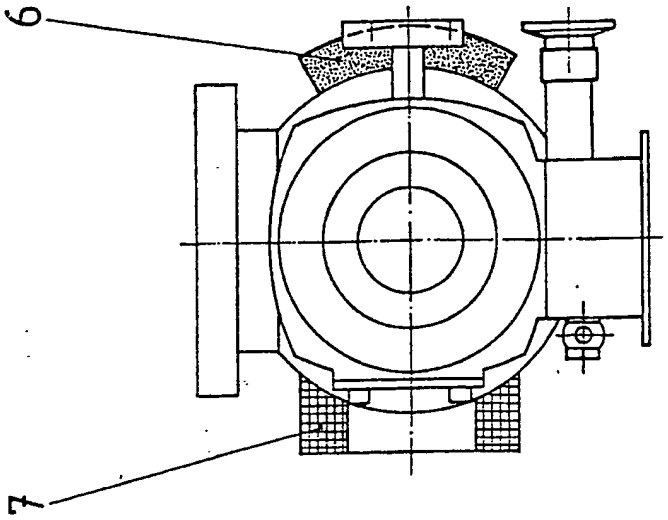


Fig.4

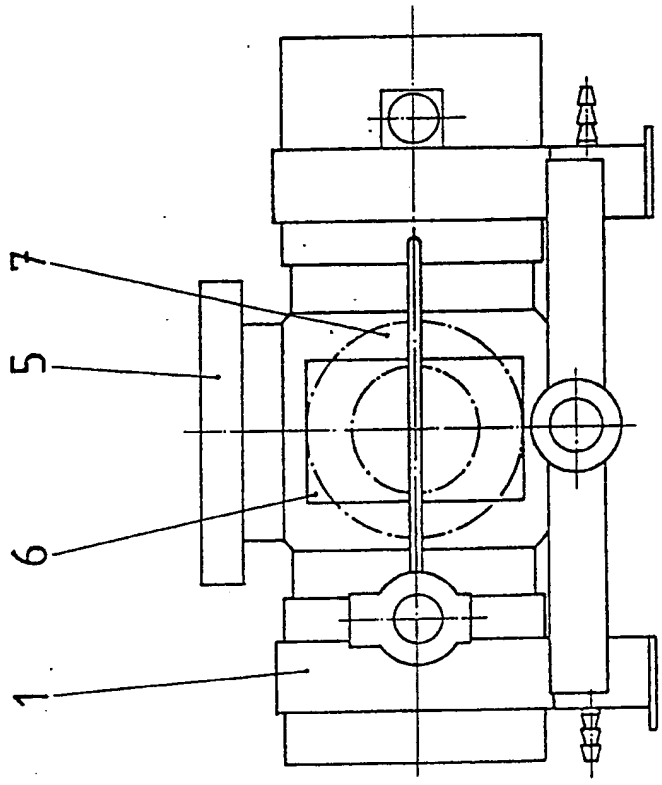


Fig.3

SPECIFICATION

**Heating arrangement for a pump**

The present invention concerns a heating arrangement for pumps, especially turbo molecular pumps.

Turbo molecular pumps are vacuum pumps for the production of high- or ultra-high vacuum. In order to shorten the times taken for evacuation, it is necessary to accelerate the desorption of the surfaces at the high vacuum side. These surfaces are constituted by the pump housing, the rotor, the rotor discs or vanes and by the stator discs or vanes. The desorption of the surfaces is accelerated by heating up these surfaces. Up to now this has been achieved by means of ohmic resistors in the form of jacket heating.

The surfaces of the housing of the turbo molecular pump at the high vacuum side are warmed relatively quickly in this way. On the other hand the surfaces of the rotor and the stator at the high vacuum side are, however, only warmed very slowly for lack of sufficient contact with the housing and because of the absence of heat conduction in vacuum. The warming occurs essentially only by means of radiation, which emanates from the warmed surface at the high vacuum side. The heating up time of the rotor and stator surfaces cannot be influenced, since only a limited heating capacity is available and the housing must not be heated above a certain temperature. At the present time the heating up time of a rotor amounts to about 6 hours.

A further disadvantage of the present methods for heating up a turbo molecular pump consists in that, upon a drop in speed of the rotor, safety precautions must be taken to switch off the heating. The present invention seeks to produce an arrangement in which the rotor- and stator surfaces of a turbo molecular pump can be warmed more quickly and more safely than with existing arrangements.

According to the present invention there is provided a heating arrangement for a pump, wherein heating up of components of the pump is produced by means of a magnetic field, of which the field lines run perpendicular to the axis of the rotor of the pump.

Thus the rotor is first heated by means of eddy currents which are produced by the interaction of its own rotation with the magnetic field.

For the transfer of the heat from the rotor discs to the stator discs by means of radiation the conditions are ideal, since the rotor- and stator discs are alternately positioned opposite to each other.

The magnetic field may be produced by means of permanent magnets or by means of electro magnets. A combination of both types is also possible. When using electro magnets the ohmic heat of the electro magnet field windings can be used at the same time for heating up the housing of the pump.

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

Fig. 1 shows a one-way turbo molecular pump with a heating arrangement in accordance with the invention;

Fig. 2 shows the arrangement of Fig. 1 in plan view;

Fig. 3 shows a two-way turbo molecular pump with a heating arrangement according to the invention; and

Fig. 4 shows a cross-sectional view along line AA of the arrangement of Fig. 3.

Figs. 1 and 2 show a one-way turbo molecular pump with the housing 1, the rotor 2 and the rotor discs or vanes 3. The stator discs or vanes 4 are arranged in an alternating manner between the rotor discs. The pump further comprises a high vacuum side connection flange or socket 5 bearings 8 and a drive motor 9. At the outer periphery of the housing 1 there are arranged permanent magnets 6 or electro magnets 7 which serve for the production of a magnetic field, of which the field lines run perpendicular to the rotor axis. The magnetic field can also be produced by a combination of permanent magnets and electro magnets.

Figs. 3 and 4 show a two-way turbo molecular pump with a heating arrangement according to the invention. The high vacuum side part is formed by the spherical housing 1. Here are mounted permanent magnets or electro magnets or a combination of the two, which produce the necessary magnetic field for heating up the rotor.

The above-described arrangements according to the invention for warming the high vacuum side surfaces of a turbo molecular pump have the following advantages with regard to the conventional arrangements:

The rotor is heated up directly and quickly by means of eddy currents. The heat can be transferred directly by means of radiation to the stator discs, since these are positioned opposite to the rotor discs. In the case of disturbances, which produce a lowering in the speed of the rotor, the heating up of the rotor is reduced. If the rotor is at a standstill the heating is out of operation, since eddy currents no longer occur.

CLAIMS

1. A heating arrangement for a pump, wherein heating up of components of the pump is produced by means of a magnetic field, of which the field lines run perpendicular to the axis of the rotor of the pump.

2. A heating arrangement for a pump according to claim 1, wherein the magnetic field is produced by one or more permanent magnets.

3. A heating arrangement for a pump according to claim 1, wherein the magnetic field is produced by one or more electro magnets.

4. A heating arrangement for a pump according to claim 3, wherein the housing and/or other non-rotating parts of the pump are heated by means of the ohmic heat of the electro magnet field

windings.

5. A heating arrangement according to any preceding claim for a turbo molecular pump wherein the components heated up are at the high vacuum side of the pump.

6. A heating arrangement according to claim 5 for a one-way turbo molecular pump the permanent magnets and/or the electro magnets being mounted beneath a flange at the high vacuum side on the outside of the housing of the pump.

7. A heating arrangement according to claim 5 for a two-way turbo molecular pump, the permanent magnets and/or the electro magnets being mounted at the high vacuum side on a spherical housing of the pump.

8. A heating arrangement for a pump substantially as herein described with reference to Figs. 1 and 2 or to Figs. 3 and 4 of the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1983. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.